Description of course	
Code of course	**1160-TR000-MSA-0203**
Name of course	***Applied Mechanics***
Version of course	2021/22
A. *Place of the course in system of studies*	
Level of education	*Second-cycle degree*
Form and mode of studies	*Full-time studies*
Field of studies	*Transport*
Profile of studies	*General academic profile*
Specialization	Subject common for the course
Place of teaching of course	*Warsaw University of Technology, Faculty of Transport, Division of Construction Fundamentals of Transport Equipment*
Place of realization of course	*Not applicable*
Coordinator of course	*Dr hab. inż. Michał Opala, ad., Division of Construction Fundamentals of Transport Equipment, Faculty of Transport, Warsaw University of Technology*
B. *General characteristic of the course*	
Group/*Block of courses*	*Core subjects*
Level of course	*Intermediate level*
Type of course	*Compulsory subject*
Language of course	*English*
Location of the course in the study plan – nominal semester	2
Location of the course in the academic year	*Summer semester*
Preliminary requirements - formal	*None.*
Limit of students	*Lecture: 100 students, exercises: 24 students.*
C. *Effects of education and manner of teaching*	
Purpose of course	*Getting to know the basics of analytical mechanics, modeling of vibrating systems, elements of analysis and synthesis of dynamical systems, including those used in transportation means.*

Effects of education with reference to the learning outcomes for the area and field of study

No. effect	***Description of the effect***	***Reference to the characteristics of learning outcomes***	***Reference to the learning outcomes in the program***
Assumed learning outcomes in terms of knowledge			
W01	Knows the basic concepts and equations of analytical mechanics.	I.P7S_WG.o	Tr2A_W03
W02	Knows the problems of analysis and synthesis of mechanical systems.	I.P7S_WG.o	Tr2A_W03
W03	Knows the methods of modeling mechanical systems and the structure of vibrating linear and nonlinear systems.	I.P7S_WG.o	Tr2A_W03 Tr2A_W10
W04	Knows the methods of analysis of mechanical systems limited by constraints.	I.P7S_WG.o	Tr2A_W03 Tr2A_W10
Assumed learning outcomes in terms of skills			
U01	Is proficient in solving tasks related to the dynamics of vibrating systems.	I.P7S_UW.o, III.P7S_UW.o	Tr2A_U12
U02	Can solve problems containing models of colliding simple mechanical systems.	I.P7S_UW.o, III.P7S_UW.o	Tr2A_U12
U03	Can model mechanical systems.	I.P7S_UW.o, III.P7S_UW.o	
Assumed learning outcomes in the field of social competences			
KS01	–	–	–

Form of didactic studies and number of hours	*Lecture*	*Exercise*	*Laboratory*	*Project*	*Other*
On a weekly plan	1	1	0	0	0
Throughout the semester	15	15	0	0	0

Contents of education - separately for each form of didactic studies	Lecture: Basic concepts of classical mechanics, principles of conservation and changeability, dynamics of a rigid body in space. Elements of the impact theory. Introduction to analytical mechanics. Generalized constraints and coordinates, virtual work, d'Alembert's principle, Lagrange's equations of the first and second kind. Mechanical vibrations. Linear vibrations of systems with one or more degrees of freedom. Nonlinear vibrations - examples of systems with one degree of freedom. Methods of analysis of vibrating systems. Methods of synthesis of vibrating systems. Modeling of mechanical systems. Exercises: Development of models of simple mechanical systems, selection of appropriate principles and methods of mechanics and making calculations.
Teaching methods	Lecture: Conventional lecture (content conveyed directly in finished form) and problem lecture (presentation of selected scientific and practical problems). Exercises: Conventional and conversational auditorium exercises.

Methods of verification of effects of education

No. effect	***Methods of verification***
	Assumed learning outcomes in terms of knowledge
W01	At least two open theory questions with computational examples. Computational examples in determining equations describing mechanical systems with one or more degrees of freedom. A score of 60% is required.
W02	A task in which students are required to calculate selected quantities such as displacements, velocities, accelerations, forces or select appropriate values of system parameters. 60% of the points are required for a passing grade.
W03	A computational task to write a mathematical model of a mechanical system. A computational task on topics such as resonance, vibration in a specific eigenmode, vibration damping. 60% of the points are required for a passing grade.
W04	A task to determine the equations of the bonds and select the appropriate generalized coordinates. A score of 60% is required for a passing grade.
	Assumed learning outcomes in terms of skills
U01	Written task, computational assignment, Lagrange's, d'Alembert's and Newton-Euler equations. A score of 60% is required for a passing grade.
U02	Written task, computational assignment, force impulse equations and restitution factor. A score of 60% is required for a passing grade.
U03	Written task, computational assignment. A score of 60% is required for a passing grade.
	Assumed learning outcomes in the field of social competences
KS01	–

Methods of evaluation	Lecture: Written credit including computational tasks and open theoretical questions or alternatively oral credit. A score of 60% is required to pass the lecture. Exercises: Written colloquium including computational tasks. A score of 60% is required to pass the exercises. Integrated Assessment: The integrated grade is the arithmetic mean of the pass marks from the exercises and the lecture.
Exam	*No*

Literature	*Primary Literature (in polish):* 1) Sawiak S., Wittbrodt E., Mechanika ogólna wybrane zagadnienia – teoria i zadania, WPG, Gdańsk 2007. 2) Szcześniak W., Nagórski R., Zbiór zadań z mechaniki teoretycznej – dynamika, OWPW, Warszawa 2020. 3) Arczewski K., Pietrucha J., Szuster A., Drgania układów fizycznych, OWPW, Warszawa 2014. 4) Rubinowicz W., Królikowski W., Mechanika teoretyczna, PWN, Warszawa 2012. *Supplementary literature (in polish):* 5) Jarzębowska E., Mechanika analityczna, OWPW, Warszawa 2003. *Primary Literature (in english):* 1) G. Housner, D. Hudson, Applied Mechanics – Dynamics, 2nd ed., Caltech, 1980. (https://core.ac.uk/download/pdf/216148055.pdf), (https://authors.library.caltech.edu/25023/1/Housner-HudsonDyn80.pdf). 2) Morin D., Introduction to Classical Mechanics With Problems and Solutions, CUP, 2008. 3) J. L. Meriam, L. G. Kraige, Engineering Mechanics, Volume 2, Dynamics, John Wiley & Sons, Inc. 4) Beer F.P., Johnston E.R.: Vector Mechanics for Engineers. Statics and Dynamics. McGraw Hill, 2019. 5) Hibbeler R. C.: Engineering Mechanics: Dynamics, 13th Edition, Prentice Hall, 2013. 6) Ginsberg J., Engineering dynamics, CUP, 2008.
Website of the course	–
D. *Student's activity*	
Number of ECTS credits	2
Number of hours of student's work to achieve effects of education	60 hours, including: the work at the lectures 15 hours, the work at the exercises 15 hours, studying the literature 8 hours, consultations 2 hours, preparation for the colloquium from the lectures 8 hours, preparation for the exercises 4 hours, preparation for the colloquium from exercises 8 hours.
Number of ECTS credits on the course with direct participation of academic teacher	1.5 points. ECTS (32 hours, including: work at lectures 15 hours, work at classes 15 hours, consultations 2 hours).
Number of ECTS credits on practical activities on the course	0
E. *Additional information*	
Notes	*As long as it does not cause changes in the relationship of a given subject with the directional effects in the content of education, changes may be introduced on an ongoing basis, taking into account the latest scientific achievements.*
Date of last edition	2021-08-23